



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

5/ Declaration  
7. Steps  
5-21-03

Applicant: Sunfei Fang

Art Unit: 2823

Serial No.: 09/941,963

Examiner: Hsien Ming Lee

Filed: August 28, 2001

Docket: 01-P-14755 US

For: Method of Cleaning an Inter-Level Dielectric Interconnect

DECLARATION FILED UNDER 37 C.F.R. § 1.131

I, Brian A. Carlson, do hereby state that:

1. I am a patent attorney (Reg. No. 37,793) with the firm of Slater & Matsil, L.L.P., and I co-wrote the above-referenced patent application.
2. Slater & Matsil, L.L.P. received an invention disclosure for the above-identified patent application from Infineon Technologies North America on April 25, 2001, which is prior to May 15, 2001, the filing date of the cited U.S. Patent Application No. 2001/0049150A1 to Nakagawa et al. A copy of the docket system report and the disclosure form is provided as Exhibit A.
3. The inventor provided me with an email showing that on May 10, 2001, the inventor sent an email to two co-workers illustrating the results of an initial etch rate study related to the inventive concept of the above-referenced patent application. A copy of the email is provided as Exhibit B.
4. Between May 16, 2001 and August 28, 2001, with the assistance of a technical writer, Mea Butler, I prepared the specification of the above-referenced patent application. A copy of the firm invoice detailing the specific dates and activities is provided as Exhibit C.


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TECHNOLOGY CENTER 2800

5. On August 28, 2001, my firm filed the patent application with the United States Patent and Trademark Office. A copy of the return postcard stamped by the United States Patent and Trademark Office is provided as Exhibit D.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1000 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

11/22/02  
Date

  
Brian A. Carlson  
Reg. No. 37,793

Slater & Matsil, L.L.P.  
17950 Preston Rd., Suite 1000  
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Tel: (972) 732-1001  
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# EXHIBIT A

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Case Tracking System  
U.S. Patent Case Detail Report

Date: April 25, 2001

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Case Number: INF-01-E-02249

Status: New

Application Type: Utility

Filing Date:

App. Serial No.:

Title: A Method of Liner Pre-Clean to Enable Formation of Reliable Contacts in Organic ILD

Case Management:

Sr. Attorney: None

Case Administrator: None

Client: INF  
Infineon Technologies North America Corp.  
Primary Contact: Stanton Braden  
186 Wood Avenue South  
Iselin, NJ 08830

Previous Cases: None

-----  
No Foreign Filing 'Reminder Date Due' present and no 'Date Foreign Filed' present

Inventor Ids: FANG NING

Abstract: None

Notes: None

No Office Actions

No Assignments

2001 E 02249 US

### Invention Disclosure

Created By: Sunfei Fang Created On: [REDACTED]  
Last Modified By: Thomas Schiml Last Modified On: [REDACTED]

Required fields are marked with the asterisk (\*) and must be filled in to complete the form.

Sequence Number [REDACTED]

Status [REDACTED]

Filed By [REDACTED]

### Plan Information

Infineon	IBM	
Docket #	IBM #	Docket #
Attorney	Attorney	Attorney
	Docket #	
	Sent to Infineon Date	

Supervising Party [REDACTED]

\* THIS PAGE IS FOR INVENTOR INFO ONLY \*

### Inventors

#### Inventor #1

\* Notes ID Sunfei Fang/Fishkill/Contr/IBM  
\* Full Name Sunfei Fang  
Serial #(if applicable)  
\* Social Security # [REDACTED]  
\* Company ☐ IBM ☒ Infineon ☐ UMC ☐ Other  
\* Department T9XA  
\* Project ☐ [REDACTED] ☐ [REDACTED] ☐ [REDACTED]  
☐ [REDACTED] ☒ [REDACTED]

#### Internal Address

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City LaGrangeville  
State NY  
Zip 12540

HOME PHONE 845 223-1727  
CITIZENSHIP CHINA

**Inv ntion Disclosur**

Created By: Sunfei Fang Created On: [REDACTED]  
Last Modified By: Sunfei Fang Last Modified On: [REDACTED]

Required fields are marked with the asterisk (\*) and must be filled in to complete the form.

Sequence Number [REDACTED]  
Status Submitted

**Plan Information**

Infineon	IBM	
Docket #	IBM #	Docket #
Attorney	Attorney	Attorney
	Docket #	
	Sent to Infineon Date	

Supervising Party [REDACTED]

**Inventors**

Sunfei Fang

Witnessed and understood by:	Witnessed and understood by:
Jay Ning [REDACTED]	Jiang Yan [REDACTED]
Signature of Witness Date	Signature of Witness Date
Jay Ning [REDACTED]	Jiang Yan [REDACTED]
Print Name of Witness	Print Name of Witness
	Jiang Yan
Telephone Number (845) 894-9536	Telephone Number 2-9546
Company Name/Location Infineon/EFK	Company Name/Location Infineon/Fishkill

**\*Title of Invention (Short & Descriptive)**

**A Method of Liner Pre-Clean to Enable Formation of Reliable Contacts in Organic ILD**

**\*Problem Solved by this Invention (Summary)**

Current liner pre-clean with Ar plasma results re-deposition of organic contaminant on contact surface. It could degrade adhesion of liner material to underlying conductor, cause contact reliability problems such as via resistance shift. This work discloses a method of liner pre-clean that will achieve organic contaminant-free clean surface. It would improve adhesion of liner material to underlying conductor and ensure formation of reliable contacts in organic ILD.

**\*List all Written Descriptions of Invention**

(eg. Described in Engineering Notebook No. Pgs. )

Cleanroom Notebook

**\*Critical Dates (mm/dd/yy or mm/dd/yyyy)**

\*Date(s) Invention Conceived:

\*Date(s) Invention Explained to Witness(es):

Date(s) Embodiment(s) of the Invention Constructed:

Date(s) Embodiment(s) of Invention Tested:

**\*Planned Use in Products; Use Outside Company; Demonstration;**

**Disclosure or Publication of the Invention (Give Dates)**

**\*Description of Invention (Text, Graphic, etc.)**



reliable contacts vs Liner Preclean.PDF

**IMPORTANT:** Information provided by this form may be used to prepare a patent application which will be signed by the inventor(s). Inventors should take great care in accurately completing this form in providing full information concerning prior art. False statements or concealment in obtaining a patent will subject applicant to fine and/or imprisonment (18 USC 1001) and may jeopardize the validity of the patent.

**\*Evaluation Aspects**

\*What exactly is your claim? Give precisely the difference between your invention (method, structure) and the closest previous work you know of.

**A Method of Liner Pre-Clean using N2 containing plasma to achieve organic contaminant-free surface. It could improve adhesion of liner material and underlying conductor, and enables formation of reliable contacts.**

\*What existing solutions are known? Please cite references, patents, etc!

None.

\*What are the TECHNICAL pros and cons over existing solutions?

**Pro: Achieve organic contaminant-free clean surface to ensure formation of reliable contacts.**

\*Have you searched for prior art? How was this search performed?

**Searched for Prior ART. Did not find any.**

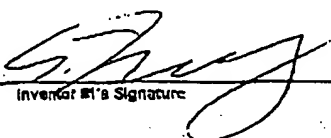

Please comment on the following:

**This Disclosure:**

**Comment:**

[REDACTED]

Do you have any other comments regarding this disclosure?

 Inventor #1's Signature	 Date	 Inventor #2's Signature	 Date
 Inventor #3's Signature	 Date	 Inventor #4's Signature	 Date
 Inventor #5's Signature	 Date		

 Witness #1's Signature	 Date	 Witness #2's Signature	 Date
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## **EXHIBIT B**

Brian Carlson

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From: Sunfei Fang  
Sent: Wednesday  
To: [REDACTED]  
Subject: Sputter pre-clean



Ar N2 sputter  
clean.doc

Brian,

My college found out original mails and forwarded back to me. Please find I forward them here.

Please let me know if you have any other suggestions.

Best Regards,  
Sunfei

----- Forwarded by Sunfei Fang/Fishkill/Contr/IBM on [REDACTED]  
-----

Keith Wong

To: Sunfei Fang/Fishkill/Contr/IBM@IBMUS  
cc: [REDACTED]  
From: Keith Wong/Fishkill/IBM@IBMUS  
Subject: Sputter pre-clean

----- Forwarded by Keith Wong/Fishkill/IBM on [REDACTED]

Sunfei Fang

To: Terry Spooner/Fishkill/IBM@IBMUS  
cc: Keith Wong/Fishkill/IBM@IBMUS  
From: Sunfei Fang/Fishkill/Contr/IBM@IBMUS  
Subject: Sputter pre-clean

05/10/2001 09:44  
AM

Terry,

Keith has done initial etch rate study with N2 addition during liner sputter pre-clean. Here is the data that you wanted: (See attached file: Ar N2 sputter clean.doc)

I'd like to talk to you (tomorrow?) to see how to proceed from here. Our proposal is:

- (i) a few short loop wafers for cross-section SEM to see if any improvement of corner-erosion;
- (ii) Electrical split to see if any improvement for via reliability

Best Regards,

Sunfei

ps could you let me know when would be a good time to discuss it?

Sample	Oxide remov.(A)	Uniformity	ETCH STEP
	post etch %		GAS FLOWS
POR (100% Ar)	97.33	1.4	5 SCCM AR
25% N2	55.92	1.37	4 AR / 1 N2
50% N2	39.6	1.47	3 AR / 2 N2
75% N2	36.15	1.36	2 AR / 3 N2



# EXHIBIT C

# Slater & Matsil, L.L.P.

F

Suite 1000  
17950 Preston Road  
Dallas, Texas 75252  
Phone: 972-732-1001 Fax: 972-732-9218

## Invoice

BILL TO
Mr. Stanton C. Braden Infineon Technologies North America c/o Siemens Corp. Legal and IP Dept. 186 Wood Avenue South Iselin, NJ 08830

PROJECT	DATE	INVOICE #
01 P 14755 (01 E 2249)	8/29/2001	1356

DATE	ATTORNEY	HRS	DESCRIPTION
PROFESSIONAL FEES			
5/16/2001	Butler	0.5	Prepare communication with inventor(s).
5/17/2001	Butler	3.5	Review file and background technology.
5/21/2001	Butler	3.5	Interview Inventor and prepare claims.
5/22/2001	Butler	8.1	Prepare patent application.
5/24/2001	Butler	4.8	Prepare patent application.
5/30/2001	Butler	4.1	Prepare patent application.
6/7/2001	Carlson	2	Review application.
6/8/2001	Butler	2	Prepare patent application.
6/12/2001	Butler	8	Revise Draft
6/20/2001	Butler	2.5	Revise application.
7/9/2001	Carlson	6	Work on application.
7/23/2001	Carlson	6.5	Work on application.
7/24/2001	Carlson	6.8	Work on application.
7/31/2001	Carlson	0.5	Teleconference with inventor re: modifications to application.
8/1/2001	Carlson	1.5	Incorporate inventor updates into application.
8/7/2001	Carlson	1	Incorporate inventor updates into application.
8/9/2001	Carlson	0.5	Teleconference with inventor re: updates to application.
8/10/2001	Carlson	0.9	Incorporate inventor updates into application.
8/15/2001	Carlson	0.3	Teleconference with inventor re: formal papers.
8/27/2001	Carlson	0.3	Review formal drawings.
8/28/2001	Carlson	0.5	Review formal papers; file application.
[REDACTED]			
OTHER CHARGES			
Filing fee for 01-P-14755			
			Total [REDACTED]

# **EXHIBIT D**

**The stamp of the USPTO, placed hereon, acknowledges receipt of:**

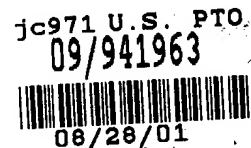
**Applicant:** Fang                      **Attorney Docket:** 01P14755 US

**Serial No:** TBD                      **Art Unit:** TBD

**Date Filed:** August 28, 2001    **Date Mailed:** August 28, 2001

**TITLE:** Method of Cleaning an Inter-Level Dielectric Interconnect

- Utility Patent Application Transmittal (1 page)
- Complete Copy of Patent Application (21 pages), to include:
  - Specification (19 pages)
  - Formal Drawings (2 pages)
- Declaration and Power of Attorney (3 pages)
- Assignment Recordation Cover Sheet (1 page)
- Copy of Original Signed Assignment (2 pages)
- Information Disclosure Statement (2 pages) and 1 reference
- Fee Transmittal (1 original and 1 copy)
- Check in the amount of \$804.00
- Two (2) Return Postcards



Received By:  
Slater & Matsil L.L.P.